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UTILITY PATENT APPLICATION TRANSMITTAL

(Only for new nonprovisional applications under 37 C.F.R. § 1.53(b))

Attorney Docket No.	585-1017
First Inventor or Application Identifier	Stevens
Title	Electronics Components Labelling
Express Mail Label No.	EL 700 383 998 US

APPLICATION ELEMENTS

See MPEP chapter 600 concerning utility patent application contents

1. [X] * Fee Transmittal Form *(e.g., PTO/SB/17)* *(Submit an original and a duplicate for fee processing)*
2. [X] Specification [*Total Pages* 12] *(preferred arrangement set forth below)*
   - Descriptive title of the Invention
   - Cross References to Related Applications
   - Statement Regarding Fed sponsored R & D
   - Reference to Microfiche Appendix
   - Background of the Invention
   - Brief Summary of the Invention
   - Bref Description of the Drawings *(if filed)*
   - Detailed Description
   - Claim(s)
   - Abstract of the Disclosure
3. [X] Drawing(s) *(35 U.S.C. 113)* [*Total Sheets* 5]
4. Oath or Declaration [*Total Pages*]
   a. [ ] Newly executed (original or copy)
   b. [ ] Copy from a prior application (37 C.F.R. § 1.63(d)) *(for continuation/divisional with Box 16 completed)*
      i. [ ] DELETION OF INVENTOR(S) Signed statement attached deleting inventor(s) named in the prior application, see 37 C.F.R. §§ 1.63(d)(2) and 1.33(b).

*** NOTE FOR ITEMS 1 & 13: IN ORDER TO BE ENTITLED TO PAY SMALL ENTITY FEES, A SMALL ENTITY STATEMENT IS REQUIRED (37 C.F.R. § 1.27), EXCEPT IF ONE FILED IN A PRIOR APPLICATION IS RELIED UPON (37 C.F.R. § 1.28).**

ADDRESS TO: **Assistant Commissioner for Patents, Box Patent Application, Washington, DC 20231**

5. [ ] Microfiche Computer Program *(Appendix)*
6. Nucleotide and/or Amino Acid Sequence Submission *(if applicable, all necessary)*
   a. [ ] Computer Readable Copy
   b. [ ] Paper Copy (identical to computer copy)
   c. [ ] Statement verifying identity of above copies

ACCOMPANYING APPLICATION PARTS

7. [ ] Assignment Papers (cover sheet & document(s))
8. [ ] 37 C.F.R.§3.73(b) Statement *(when there is an assignee)* [ ] Power of Attorney
9. [ ] English Translation Document *(if applicable)*
10. [ ] Information Disclosure Statement (IDS)/PTO-1449 [ ] Copies of IDS Citations
11. [ ] Preliminary Amendment
12. [X] Return Receipt Postcard (MPEP 503) *(Should be specifically itemized)*
13. [ ] * Small Entity Statement(s) *(PTO/SB/09-12)* [ ] Statement filed in prior application, Status still proper and desired
14. [ ] Certified Copy of Priority Document(s) *(if foreign priority is claimed)*
15. [ ] Other: .....

16. **If a CONTINUING APPLICATION,** *check appropriate box, and supply the requisite information below and in a preliminary amendment.*
    [ ] Continuation [ ] Divisional [ ] Continuation-in-part (CIP) of prior application No _____/_____
    Prior application information: Examiner _____ *Group / Art Unit:* _____

For CONTINUATION or DIVISIONAL APPS only: The entire disclosure of the prior application, from which an oath or declaration is supplied under Box 4b, is considered a part of the disclosure of the accompanying continuation or divisional application and is hereby incorporated by reference. The incorporation can only be relied upon when a portion has been inadvertently omitted from the submitted application parts.

17. CORRESPONDENCE ADDRESS

[ ] *Customer Number or Bar Code Label* *(Insert Customer No. or Attach bar code label here)* or [X] *Correspondence address below*

Name	William M. Lee, Jr.				
	Lee, Mann, Smith, McWilliams, Sweeney & Ohlson				
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Name (Print/Type)	William M. Lee, Jr.	*Registration No. (Attorney/Agent)*	26,935
Signature		*Date*	10/27/00

Burden Hour Statement: This form is estimated to take 0.2 hours to complete. Time will vary depending upon the needs of the individual case. Any comments on the amount of time you are required to complete this form should be sent to the Chief Information Officer, Patent and Trademark Office, Washington, DC 20231. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. SEND TO: Assistant Commissioner for Patents, Box Patent Application, Washington, DC 20231

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FEE TRANSMITTAL for FY 1999

Patent fees are subject to annual revision

Small Entity payments must be supported by a small entity statement, otherwise large entity fees must be paid. See Forms PTO/SB/09-12.

TOTAL AMOUNT OF PAYMENT ($) 1084

Complete if Known	
Application Number	
Filing Date	
First Named Inventor	Stevens
Examiner Name	
Group / Art Unit	
Attorney Docket No.	585-1017

METHOD OF PAYMENT (check one)

1. [X] The Commissioner is hereby authorized to charge indicated fees and credit any over payments to:

Deposit Account Number: 12-0913

Deposit Account Name: Lee, Mann, Smith, McWilliams, Sweeney & Ohlson

[X] Charge Any Additional Fee Required Under 37 CFR 1 16 and 1 17

2. [X] Payment Enclosed:

[X] Check [ ] Money Order [ ] Other

FEE CALCULATION

1. BASIC FILING FEE

Large Entity Fee Code	Large Entity Fee ($)	Small Entity Fee Code	Small Entity Fee ($)	Fee Description	Fee Paid
101	760	201	380	Utility filing fee	710
106	310	206	155	Design filing fee	
107	480	207	240	Plant filing fee	
108	760	208	380	Reissue filing fee	
114	150	214	75	Provisional filing fee	

SUBTOTAL (1) ($) 710

2. EXTRA CLAIM FEES

			Extra Claims		Fee from below		Fee Paid
Total Claims	23	-20** =	3	X	18	=	54
Independent Claims	7	- 3** =	4	X	80	=	320
Multiple Dependent						=	

***or number previously paid, if greater, For Reissues, see below*

Large Entity Fee Code	Large Entity Fee ($)	Small Entity Fee Code	Small Entity Fee ($)	Fee Description
103	18	203	9	Claims in excess of 20
102	78	202	39	Independent claims in excess of 3
104	260	204	130	Multiple dependent claim, if not paid
109	78	209	39	** Reissue independent claims over original patent
110	18	210	9	** Reissue claims in excess of 20 and over original patent

SUBTOTAL (2) ($) 374

FEE CALCULATION (continued)

3. ADDITIONAL FEES

Large Entity Fee Code	Large Entity Fee ($)	Small Entity Fee Code	Small Entity Fee ($)	Fee Description	Fee Paid
105	130	205	65	Surcharge - late filing fee or oath	
127	50	227	25	Surcharge - late provisional filing fee or cover sheet.	
139	130	139	130	Non-English specification	
147	2,520	147	2,520	For filing a request for reexamination	
112	920*	112	920*	Requesting publication of SIR prior to Examiner action	
113	1,840*	113	1,840*	Requesting publication of SIR after Examiner action	
115	110	215	55	Extension for reply within first month	
116	380	216	190	Extension for reply within second month	
117	870	217	435	Extension for reply within third month	
118	1,360	218	680	Extension for reply within fourth month	
128	1,850	228	925	Extension for reply within fifth month	
119	300	219	150	Notice of Appeal	
120	300	220	150	Filing a brief in support of an appeal	
121	260	221	130	Request for oral hearing	
138	1,510	138	1,510	Petition to institute a public use proceeding	
140	110	240	55	Petition to revive - unavoidable	
141	1,210	241	605	Petition to revive - unintentional	
142	1,210	242	605	Utility issue fee (or reissue)	
143	430	243	215	Design issue fee	
144	580	244	290	Plant issue fee	
122	130	122	130	Petitions to the Commissioner	
123	50	123	50	Petitions related to provisional applications	
126	240	126	240	Submission of Information Disclosure Stmt	
581	40	581	40	Recording each patent assignment per property (times number of properties)	
146	760	246	380	Filing a submission after final rejection (37 CFR 1 129(a))	
149	760	249	380	For each additional invention to be examined (37 CFR 1 129(b))	

Other fee (specify) ______________

Other fee (specify) ______________

* Reduced by Basic Filing Fee Paid

SUBTOTAL (3) ($) 0

SUBMITTED BY				Complete (if applicable)	
Typed or Printed Name	William M. Lee, Jr.			Reg. Number	26,935
Signature	[signature]	Date	10/27/00	Deposit Account User ID	

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

APPLICATION FOR LETTERS PATENT

BY

Robert A. Ford
Little Eden
20 Manscombe Road
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TQ2 6SP
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United Kingdom

FOR

ELECTRONICS COMPONENTS LABELLING

ELECTRONICS COMPONENTS LABELLING

FIELD OF THE INVENTION

The invention relates to the identification of electronics components, particularly optoelectronics components, optoelectronics components carriers and optoelectronics components packages.

BACKGROUND OF THE INVENTION

Semi-conductor laser diodes, of the type used in optical fibre communications networks as optical signal sources, are generally fabricated from silicon wafers. Typically, a wafer will yield in the region of 6,000 laser diodes. Current optical networks operate with in excess of 160 different wavelengths of optical signal. Each wafer is usually dedicated to producing laser diodes operable at one specific signal wavelength.

For use in optical networks, each of the laser diodes in a wafer is separated from all the others and is generally installed on an optoelectronics component carrier. Each carrier is effectively a printed circuit board-type mounting for the laser diode and other components, such as capacitors or thermistors, which go to make up an optoelectronics product. The board consists essentially of a substrate with conductive tracks applied to its surface, electrically interconnecting the components. The components and the carrier may be packaged.

Each component, and thus each packaged product of which each component becomes a part, has a unique set of data associated with it. The careful management of this data is essential from the perspective of product work in progress management, component tracking and product operation. For instance, an efficient production

process demands a thorough knowledge of work in progress. It may be necessary to be able to trace, for instance, a laser diode back to the wafer from which it was derived or a capacitor or thermistor or any component forming part of the package back along its supply route. Test data needs to be carried forward to product operation. Laser diodes, for example, may be power rated through a test procedure during the product packaging process and the rating is the one at which the laser diode needs ultimately to operate. Moreover, such ratings can vary from laser diode to laser diode.

The ability to link all the associated critical data to each component or component carrier during any production or packaging step is crucial. At present, optoelectronics product packaging lines may achieve such link using so-called waffle packs. These are two dimensionally partitioned flat packs with of the order of 50-80 cells defined by the partitioning. Each cell serves as a storage location for a component or component carrier throughout the production or packaging process. Each storage location is defined in terms of its row and column position in a particular orientation of the pack. The orientation may be defined by a reference mark, such as a chamfered corner. Each pack is assigned a batch number so that each component or component carrier is identifiable within a batch according to its positional data. The batch number is generally applied to the lid of the pack. Data critical to each component or component carrier may be handled using paper batch sheets and a software map with data for each component or component carrier stored in the corresponding software map location.

At any batch stage in production, each waffle pack is usually offered up to whatever equipment is involved in that stage: all of the components or component carriers may be removed and subsequently replaced following the stage processing. Each component is processed in accordance with the data held in the corresponding location in the software map. If, between removal of the component or component carrier for processing and replacement, the lid of the waffle pack bearing the batch number is lost or misplaced, the waffle pack is rotated, or if components or

component carriers are not replaced in the correct position or components become dislodged, each component or component carrier can no longer easily be linked to its critical data and the production process may be hampered by the delay in re-establishing the situation. At worse, a batch of components may have to be discarded if the situation is irretrievable.

For an optical network package, the component carriers upon which laser diodes tend to be mounted may only be of the order of 5mm x 6mm. As the surface area of the carrier is largely occupied by components, little space is available to apply a label bearing an identifier or the data critical to the component or component carrier. Similarly, each component is so small as to offer very little if any spare space for the attachment of a label.

It is known to label products with coded data labels. These typically comprise a substrate, for example adhesive paper, bearing data encoded as a symbol, such as one-dimensional bar code. The data may be read using suitable optical reading apparatus, such as a laser scanner, and decoded with appropriate processing circuitry.

Conventional coded data labels are too big for accommodation on the space available on an optoelectronics component or component carrier.

OBJECT OF THE INVENTION

The object of the invention is to provide a label for attachment to electronics components, components carriers or components packages; a method of labelling electronics components; a vision system for reading a coded data symbol on an electronics component label; an electronics component labelling system; a labelled electronics component and a method of producing a label for electronics components.

SUMMARY OF THE INVENTION

According to a first aspect, the invention provides a label for electronics components comprising a substrate, a coded data symbol carried by the substrate, wherein the format of the symbol is such as to facilitate accommodation of the substrate on components or carriers for the components.

Having a label which can be attached directly to components or component carriers enables each to be labelled individually during a production and packaging process. As a consequence, the component or carrier is always able to be linked to its critical data, which makes for efficient critical data management. Preferably, the component or component carrier is given a unique identifier, such as a serial number, and all critical data for the component or carrier is built up and stored in a database, for instance on a PC or similar electronic storage means, at a location addressable according to the unique identifier. Thus, simply by obtaining the identifier, the critical data may be retrieved at any time. In addition, a component may be assigned to a batch and its batch number can be included in the critical data. Consequently, batch numbers are fully recoverable. Also, it is not critical that components remain in a specific position in, say, a waffle pack, components will not have to be discarded as a result of mismatching data, operator time will not be consumed rectifying loss of data errors and data on any component may be retrievable at any time during the production process.

Preferably, the format of the symbol is such that the space requirements of the substrate are less than is available on a component or component carrier. There are various suitable formats of symbol such as those known under the designations Data Matrix, MaxiCode, Code One, Aztec Code or QR Code, but the Data Matrix format is preferred. Each has a predefined coding algorithm for encoding data as a pattern of lines, bars, dots or squares etc or any combination thereof as a one or two dimensional symbol. In the case of the Data Matrix format, the symbol comprises a square or rectangular matrix of cells and the coding of the data encapsulated in the symbol determines whether the individual cells are left blank or filled in, so as to

form an overall coded pattern. Within each format there may be further sub-formats. For example, there are various ECC specifications within the Data Matrix format and, for instance, the ECC-200 specification defines a specific size of row x column matrix which enables the encoding of up to 12 data characters in a symbol occupying 300μm x 300μm. Thus, the substrate need only be of the order nominally of 460μm x 460μm. However, the symbol, and hence the substrate, could be smaller.

The substrate may be any material suitable for attachment to a component or component carrier and the symbol may be applied by any suitable method. Preferably, for compatibility with microelectronics components, the substrate is a semiconductor wafer material to which an etchable layer is applied and the symbol is etched into the etchable layer. For example, the wafer material may be silicon nitride and the etchable layer may be gold. The gold may be etched so as to leave gold in those parts corresponding to filled in cells, offering a bright, reflective surface, and no gold in those parts corresponding to blank squares, offering a dark surface. When it comes to reading the symbol, it is the contrast between the bright and dark cells which is important. Further preferably, the etching may be performed using an electron beam or using any other etching technique which can etch accurately at the dimensions required for accommodation of the label on a component. Standard mask techniques are not altogether suitable in situations where each symbol required is unique as this would necessitate a different mask for each symbol, which is uneconomical. Electron beam etching, however, provides the flexibility to easily vary the symbol from label to label.

The symbol has to be read and decoded. The reading is achieved by a vision system comprising light source means for illuminating the symbol, reflection detection means for detecting the reflected light pattern corresponding to the symbol and processing means for decoding the reflected light pattern. Reflection capturing apparatus and light pattern decoding apparatus are well known. Preferably, the light source produces diffuse red light.

The substrate could be the component or components carrier substrate such as the component semiconductor wafer so that the label could be applied directly to the component or carrier rather than as a separate label.

According to a second aspect, the invention provides a method of labelling electronics components comprising attaching to components or carriers for components a substrate carrying a coded data symbol.

According to a third aspect, the invention provides a vision system for reading a coded data symbol on an electronics component label comprising means for producing light for illuminating the symbol and means for detecting the pattern of light reflected from the symbol. Preferably, the light producing means produces diffuse red light.

According to a fourth aspect, the invention provides an electronics component labelling system comprising a label carrying a coded identifier symbol for attachment to a component or component carrier, a vision system for reading and decoding the label and data storage means for storing at a location identifiable according to the decoded identifier data relevant to the component.

According to a fifth aspect, the invention provides an electronics component or component carrier having a label attached thereto, which label comprises a substrate, a coded data symbol carried by the substrate, wherein the format of the symbol is such as to facilitate accommodation of the substrate on the components or carrier.

According to a sixth aspect, the invention provides a method of producing a label for electronics components comprising providing a substrate, providing an etchable layer on the substrate and etching the etchable layer. Preferably, the etching is performed using an electron beam technique.

BRIEF DESCRIPTION OF THE DRAWINGS

Figure 1 is a schematic plan view of the layout of a optoelectronics component carrier to which is applied a label according to the invention;

Figure 2 is a schematic plan view of a label according to the invention;

Figure 3 is a side cross sectional view of a label according to the invention;

Figure 4 is a schematic side view of vision system for reading and decoding a label according to the invention; and

Figure 5 is a schematic side view of electron beam etching apparatus.

DESCRIPTION OF THE INVENTION

With reference to figure 1, an optoelectronics component carrier indicated generally at 2 has a substrate 4 on the surface of which is a arrangement of conducting strips 6. The conducting strips 6 provide the electrical interconnections between components 8 mounted on the carrier. One of the components 8a is a laser diode. In the figure the carrier is significantly magnified and would in reality be in the order of 5mm x 6mm.

Situated adjacent one of the components 8b, but in a region of the carrier 2 in which there are no components 8 mounted on the substrate 4, and hence there is free space, is a component carrier label 10. With reference also to figure 2, the label 10 comprises a substrate 12 nominally measuring 460μm x 460μm. On the surface of the substrate 12 is a symbol 14. The symbol 14 is in Data Matrix ECC-200 format consisting of 12 row x 12 column matrix of cells. Each matrix cell, that is, each row/column intersection is in either one of two states, blank or filled in. The combination of all the cell states constitutes an encoded identifier, a serial number, for the carrier 2 and all the components 8 mounted on it.

Critical data for the component carrier 2, such as the batch number for the laser diode 8a and its operational values determined during testing, are stored within a database

in a PC 28 (see figure 4) at a location addressable in accordance with the serial number.

With reference also to figure 3, the substrate 12 is a silicon nitride wafer . Applied to the wafer are successive 1000 Å thick layers of chromium 30 and gold 32. Using an electron beam etching apparatus 34 (see figure 5), gold within the boundaries of the symbol is etched according to a desired pattern. In other words, gold 32 is removed from the locations corresponding to matrix cells which are to be left blank and untouched in the locations corresponding to matrix cells which are to be filled in. Thus, the matrix is in the form of a pattern of gold and non-gold cells. The gold cells are bright and reflective whereas the non-gold cells are dark.

With reference to figure 4, the symbol 14 is read and decoded using a vision system indicated generally at 20 having diffused red light source 22 for projecting diffuse red light on to and illuminating the symbol 14 and a reflected light detection apparatus 24 for detecting the pattern of light reflected from the symbol 14 and processing circuitry 26 for decoding the reflected pattern. The diffused red light from the source 22 is scanned across the symbol 14 and the resulting reflected pattern of light corresponding, because of the reflective and non-reflective nature of the filled in and blank matrix cells respectively, is captured as an image by the detection apparatus 24. The captured image is analysed by the processing circuitry 26 and, by applying the Data Matrix ECC-200 coding algorithm in reverse, is decoded. This decoding generates the serial number which can then be used to address a location in the database in the PC 28 where the data critical to the component or component carrier is stored.

CLAIMS

1. A label for electronics components comprising a substrate, a coded data symbol carried by the substrate, wherein the format of the symbol is such as to facilitate accommodation of the substrate on components or carriers for the components.

2. A label according to claim 1 wherein the data which is encoded as the symbol is an identifier of components or carriers.

3. A label according to claim 2 wherein data relating to components or carriers is stored in a database at a location addressable according to the identifier.

4. A label according to claim 1 wherein the format of the symbol is such that the space requirements of the substrate are less than is available on components or component carriers.

5. A label according to claim 4 wherein the symbol is in Data Matrix, MaxiCode, Code One, Aztec Code or QR Code format.

6. A label according to claim 1 wherein the symbol is in the region of 300μm x 300μm or less.

7. A label according to claim 1 wherein the substrate is of the order of 460μm x 460μm or less.

8. A label according to claim 1 wherein the substrate is a semiconductor wafer material.

9. A label according to claim 8 wherein the wafer material is silicon nitride

10. A label according to claim 1 wherein an etchable layer is applied to the substrate and the symbol is etched into the etchable layer.

11. A label according to 10 claim wherein the etchable layer is gold.

12. A label according to claim 11 wherein the gold is etched so as to leave gold, bright reflective surface parts, and non-gold, darker surface parts.

13. A label according to claim 10 wherein the etching is performed using an electron beam technique

14. A label according to claim 1 wherein the symbol is read and decoded using a vision system comprising light source means for illuminating the symbol, reflection detection means for detecting a reflected light pattern corresponding to the symbol and processing means for decoding the reflected light pattern.

15. A label according to claim 14 wherein the light source produces diffuse red light.

16. A label according to claim wherein the substrate is a component or component carrier substrate.

17. A method of labelling electronics components comprising attaching to the components or carriers for the components a substrate carrying a coded data symbol.

18. A vision system for reading a coded data symbol on an electronics component label comprising means for producing light for illuminating the symbol and means for detecting the pattern of light reflected from the symbol.

19. A vision system according to claim 18 wherein the light producing means produces diffused red light.

20. An electronics component labelling system comprising a label carrying a coded identifier symbol for attachment to a component or component carrier, a vision system for reading and decoding the label and data storage means for storing at a location identifiable according to the decoded identifier data relevant to the component.

21. An electronics component or component carrier having a label attached thereto, which label comprises a substrate, a coded data symbol carried by the substrate, wherein the format of the symbol is such as to facilitate accommodation of the substrate on the components or carrier.

22. A method of producing a label for electronics components comprising providing a substrate, providing an etchable layer on the substrate and etching the etchable layer.

23. A method according to claim 22 wherein the etching is performed using an electron beam technique.

ABSTRACT

A label 10 for electronics components has a substrate 12 and a coded data symbol 14 carried by the substrate, for instance a silicon nitride wafer. The format of the symbol 14, preferably Data Matrix, is such as to facilitate accommodation of the substrate 12 on the limited space available on components 8 or carriers 2 for the components 8. The symbol 14 is formed by etching an etchable layer 32, such as gold, using an electron beam technique and is read with a vision system 20 wherein diffuse red light is projected on to the symbol and the reflected pattern, corresponding to the pattern of the symbol 14, is captured and decoded.

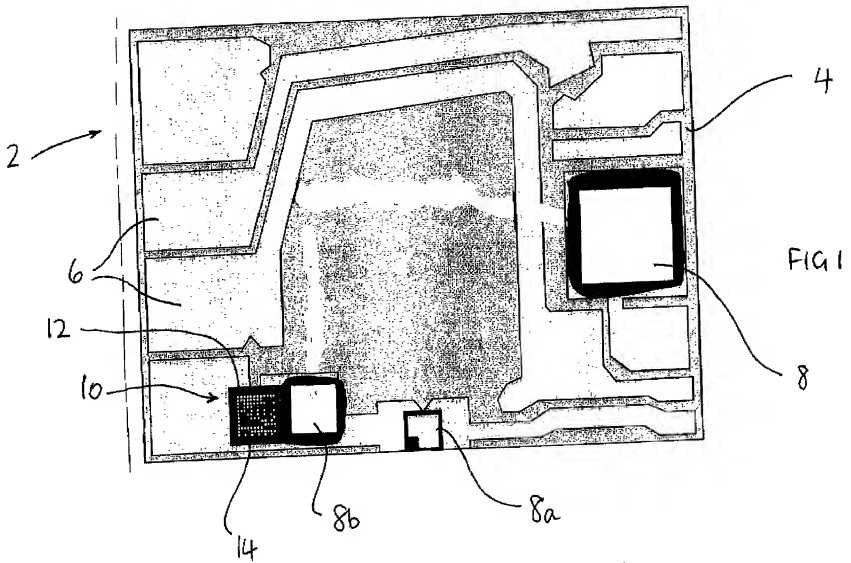

FIG 1

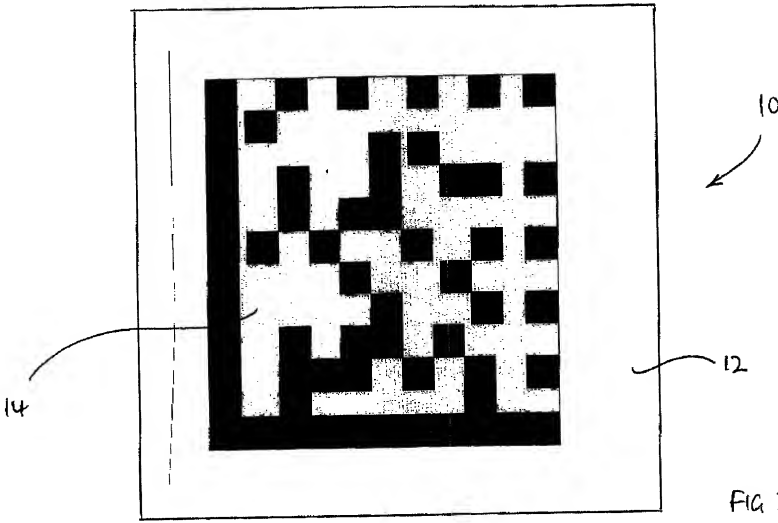

FIG 2.

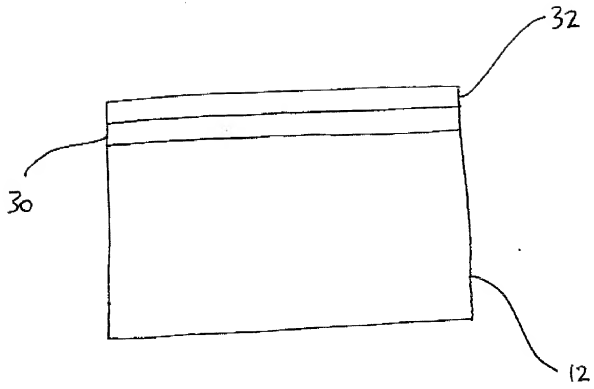

FIG 3.

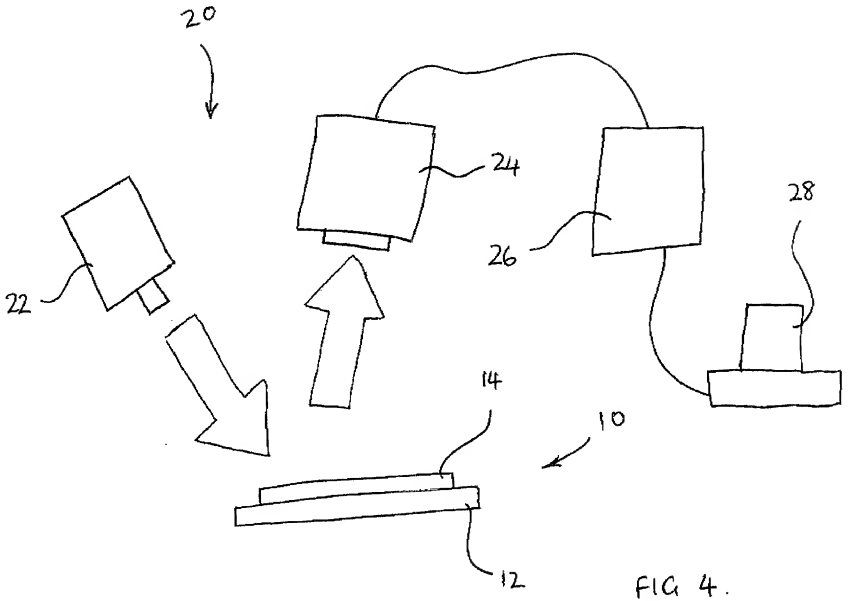

FIG 4.

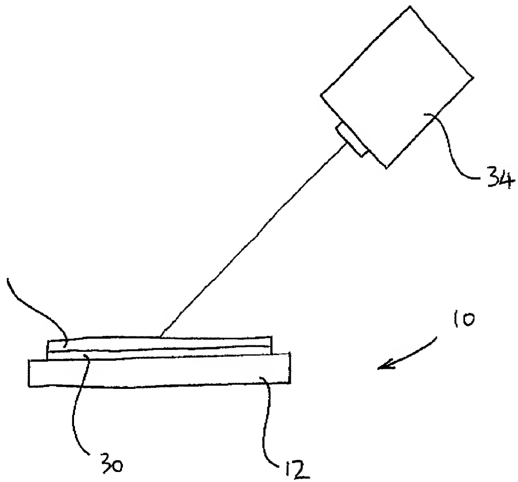

FIG 5.